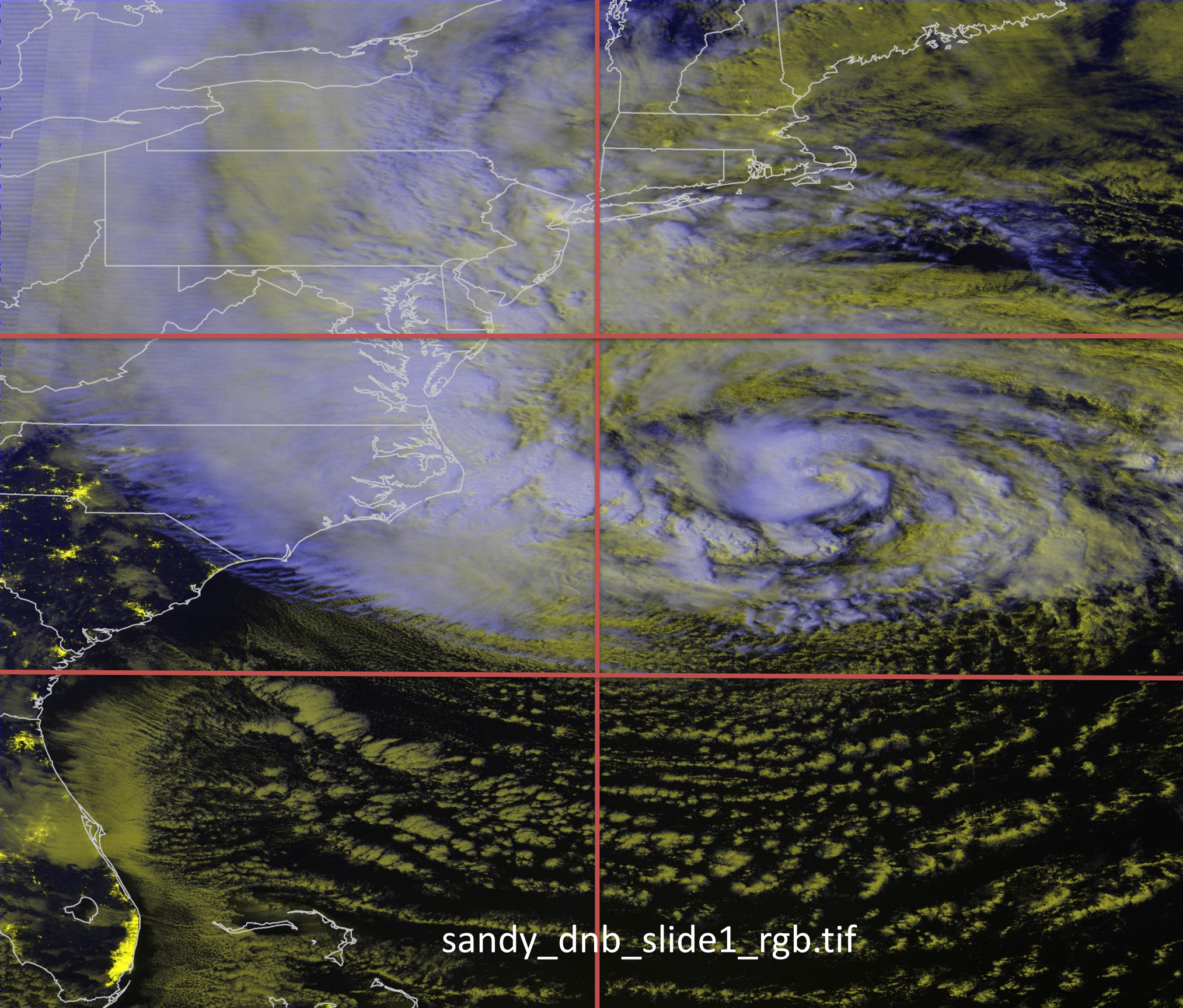




Applications of NASA and NOAA
Satellite Observations by NASA's Short-
term Prediction Research and
Transition (SPoRT) Center in Response
to Natural Disasters

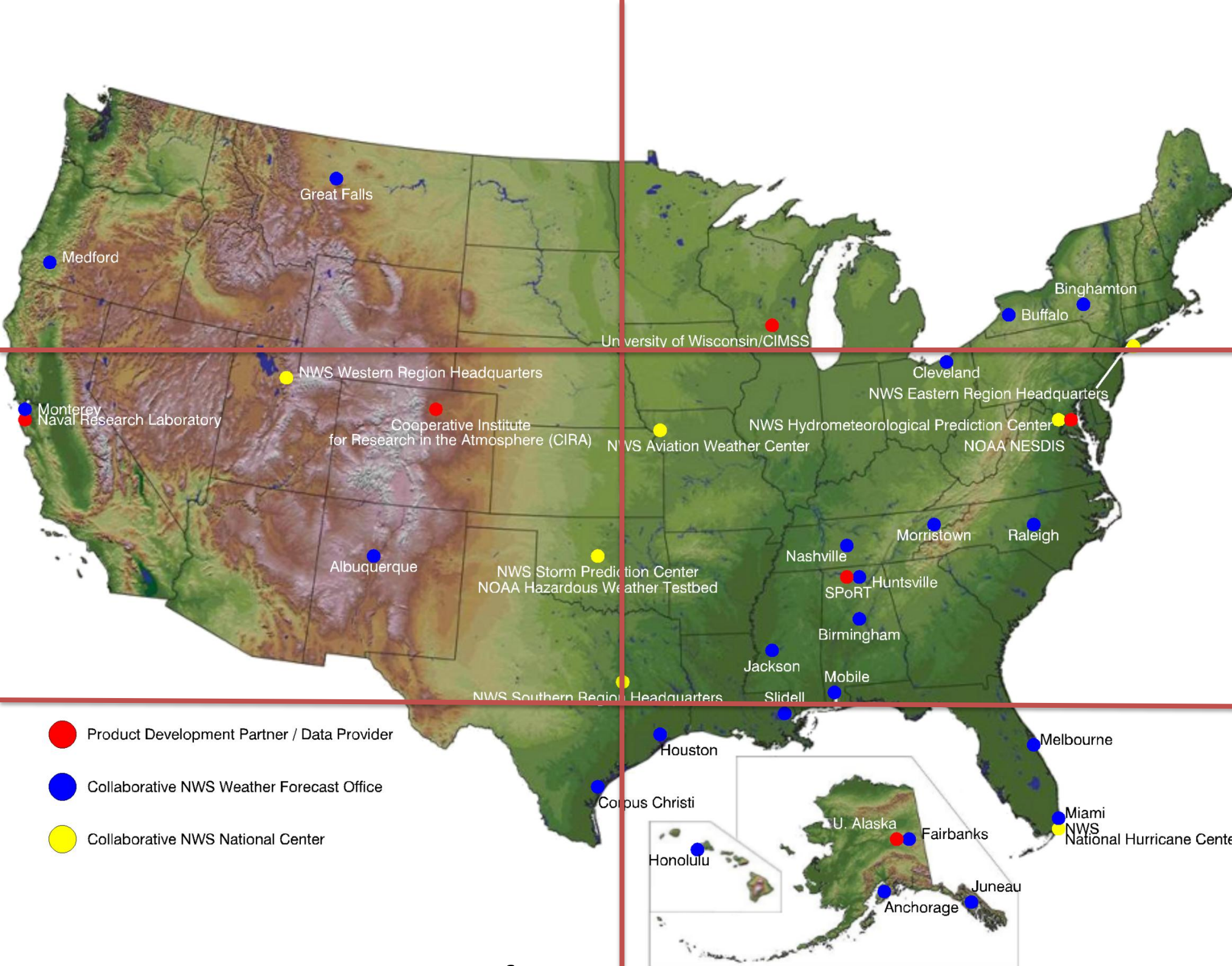
Andrew L. Molthan, Jason E. Burks,
Kevin M. McGrath, and Gary J. Jedlovec

NASA Short-term Prediction Research
and Transition (SPoRT) Center,
Huntsville, Alabama



NASA Short-term Prediction Research
and Transition (SPoRT) Center,
Huntsville, Alabama

weather.msfc.nasa.gov/sport

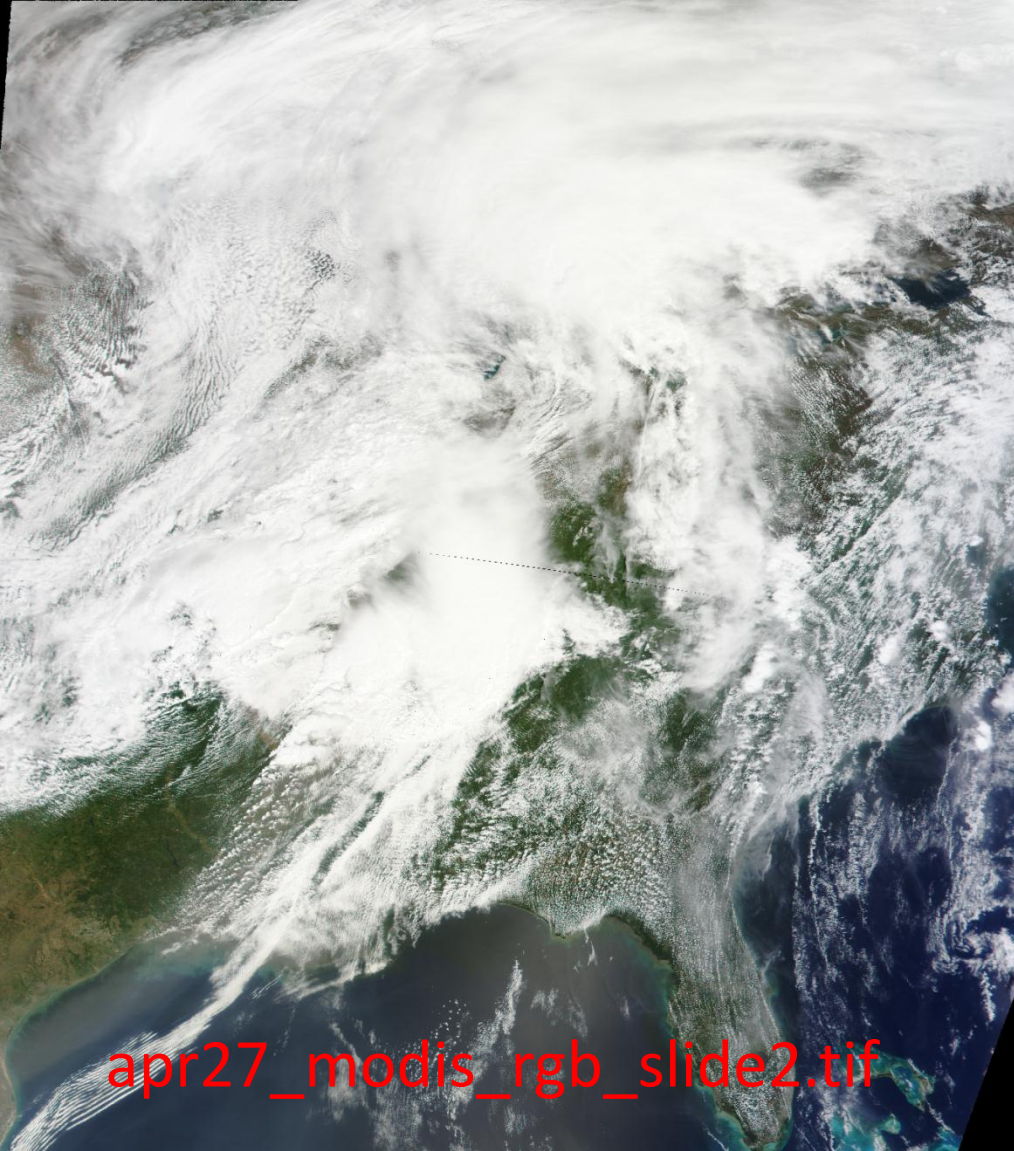


NASA's Short-term Prediction Research and Transition (SPoRT) Center supports the transition of unique NASA and NOAA research activities to the operational weather forecasting community. SPoRT emphasizes real-time analysis and prediction out to 48 hours.

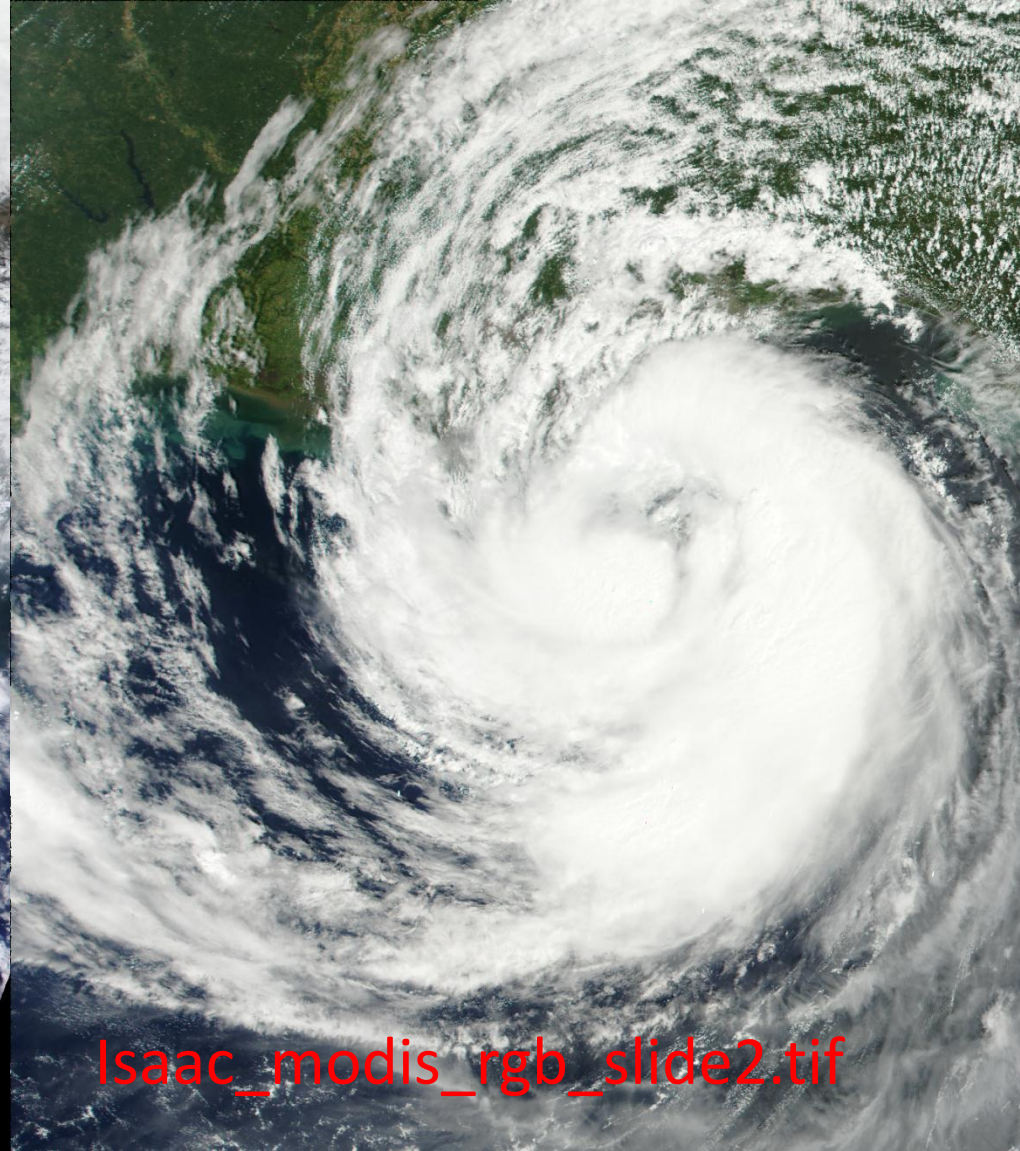
SPoRT partners with NOAA's National Weather Service (NWS) Weather Forecast Offices (WFOs) and National Centers to improve current products, demonstrate future satellite capabilities and explore new data assimilation techniques.

Recently, the SPoRT Center has been involved in several activities related to disaster response, in collaboration with NOAA's National Weather Service, NASA's Applied Sciences Disasters Program, and other partners.

sport_map.tif



apr27_modis_rgb_slide2.tif



Isaac_modis_rgb_slide2.tif

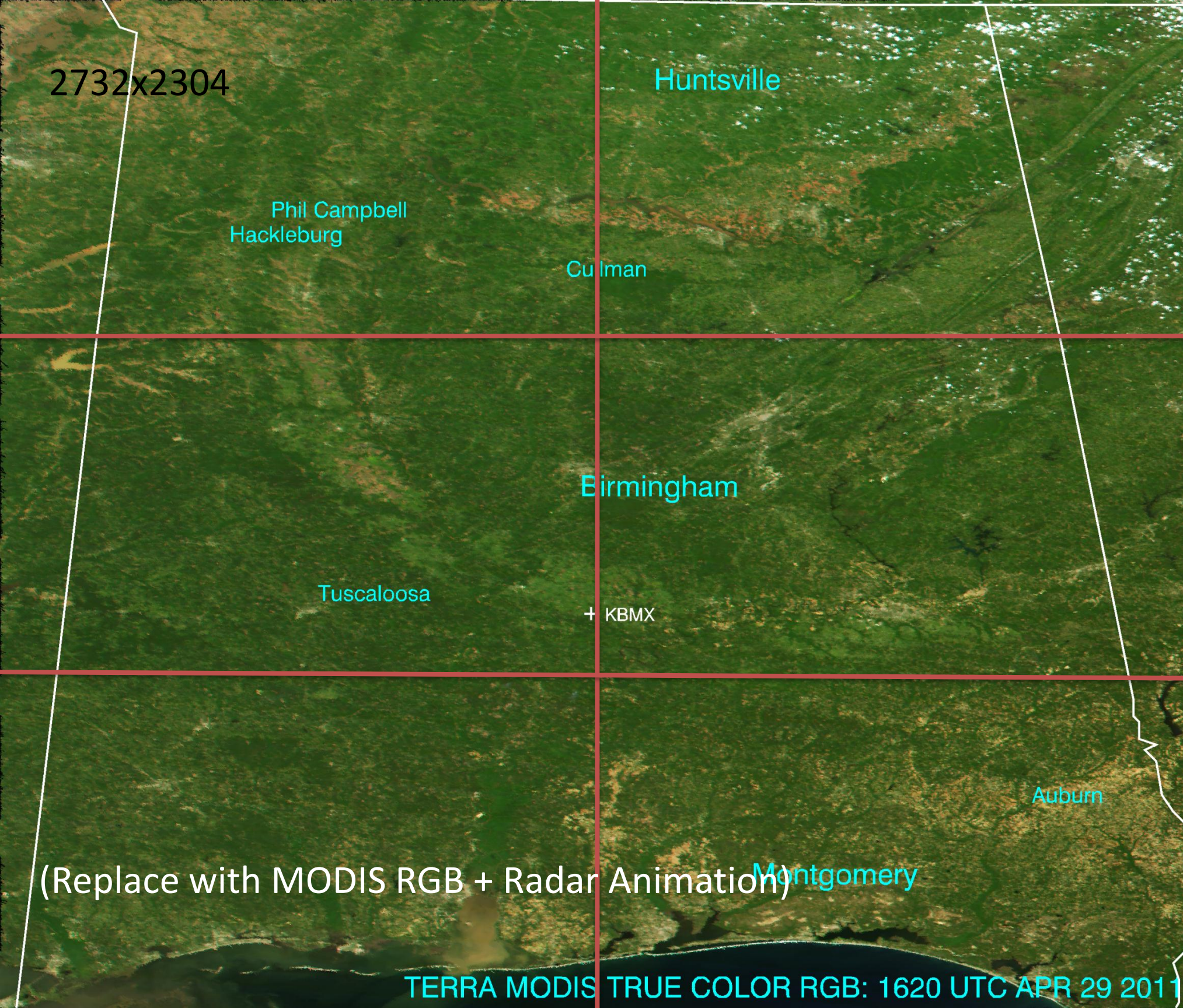


Sandy_modis_rgb_slide2.tif

The severe weather outbreak of April 27, 2011 produced dozens of tornadoes across Mississippi, Alabama, and Georgia, resulting in widespread property damage and the tragic loss of hundreds of lives.

Hurricane Isaac affected the Gulf Coast in late August and made landfall in the New Orleans, Louisiana area just prior to Labor Day in 2012. Heavy rains and storm surge led to widespread coastal and inland flooding, and the tropical cyclone's strong winds led to extensive power outages.

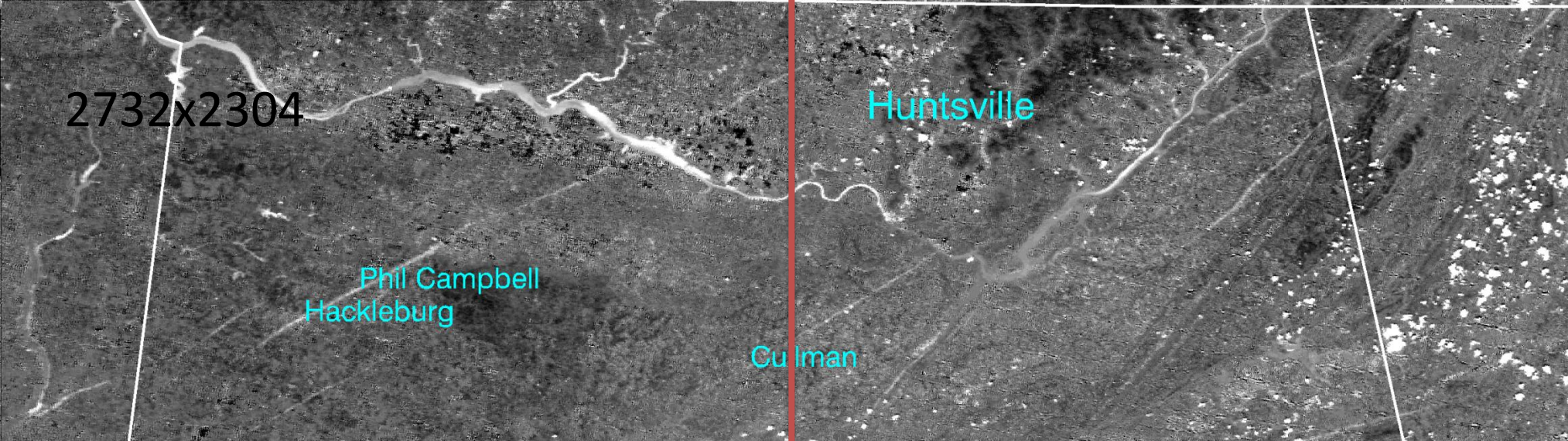
In late October 2012, then-Hurricane Sandy interacted with another midlatitude storm system to produce "Superstorm Sandy", which created significant coastal flooding, inland flooding, wind damage, and power outages in the Northeast.



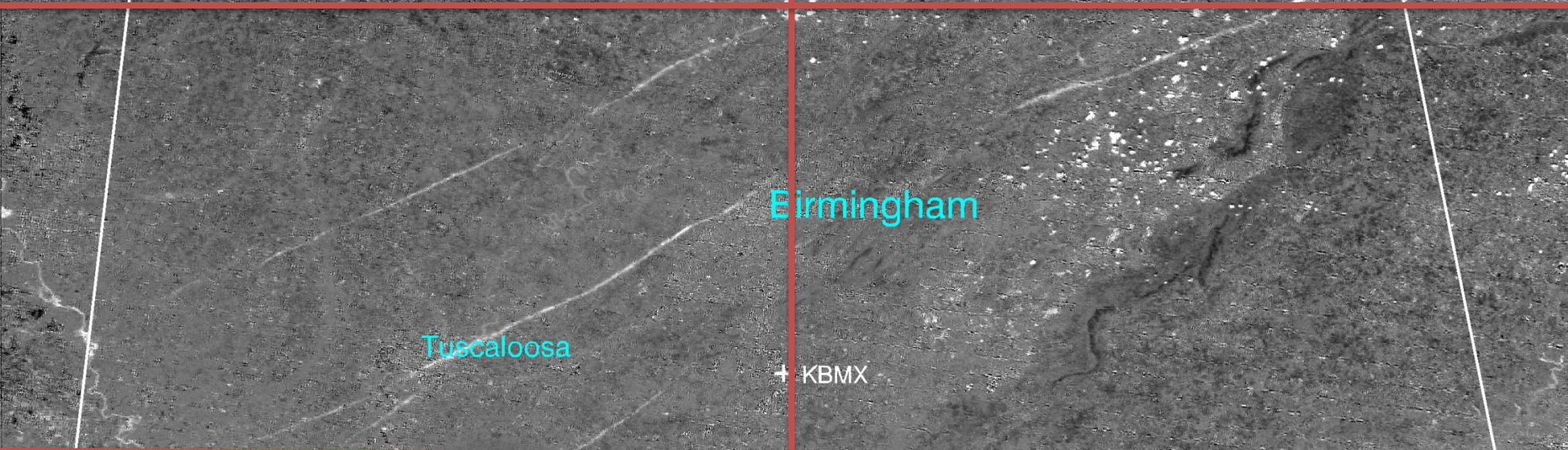
MODIS true color imagery are provided by SPoRT to the National Weather Service at 500 m resolution. True color imagery are helpful for identifying fires and smoke, snow cover, and other features.

Here, a MODIS true color image from April 29 is shown beneath a radar loop of severe thunderstorms that occurred on April 27, 2011.

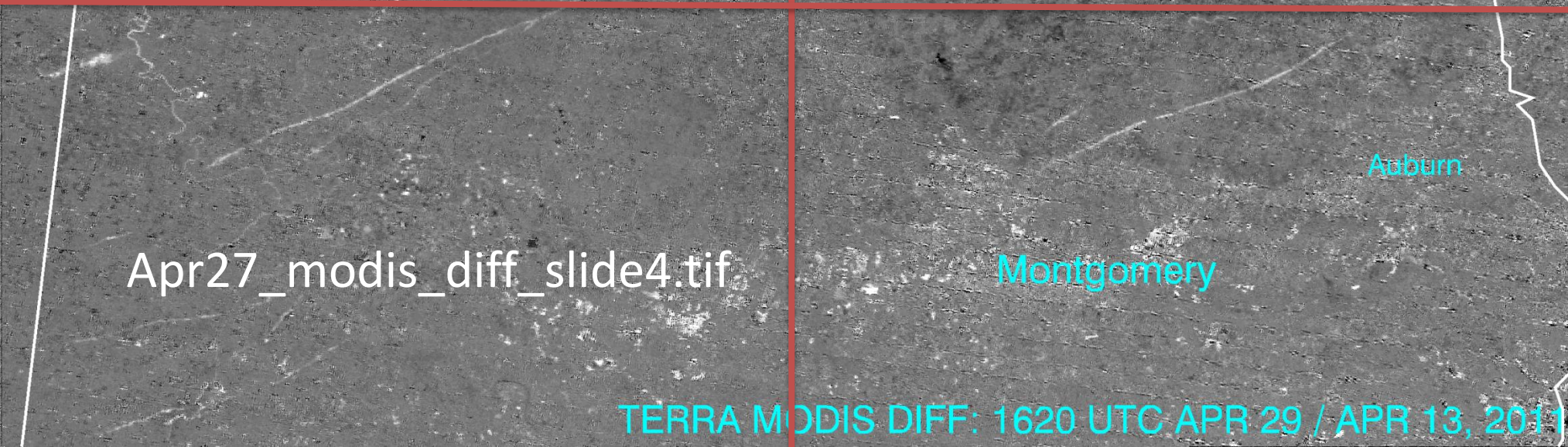
Significant tornadoes, classified by the “Enhanced Fujita” scale and categorized as an EF2 through EF5, often lead to stark changes in vegetation that are apparent in true color imagery as “scars” on the surface.



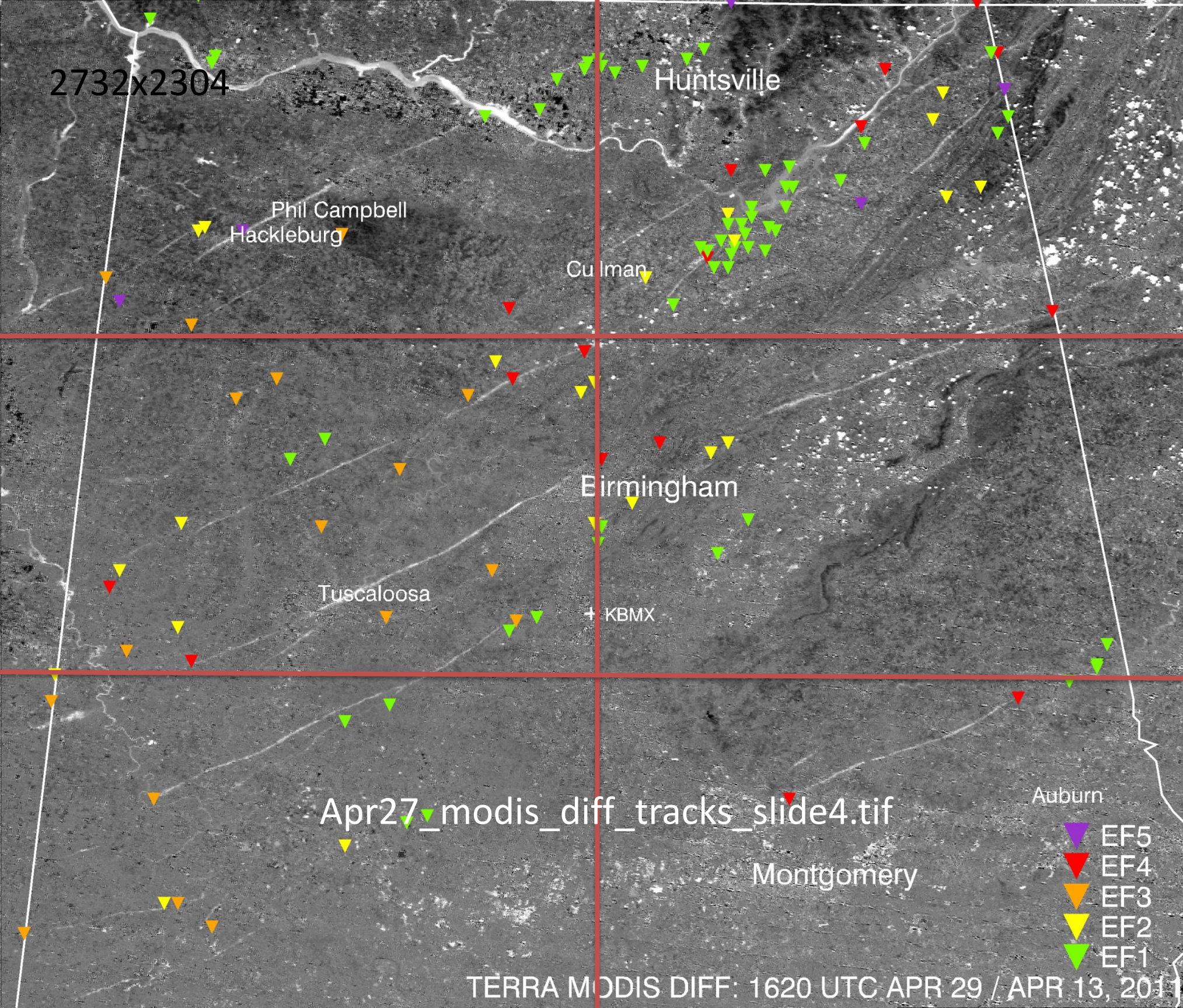
MODIS provides a 250 m resolution band focusing on reflected red light, which is helpful for monitoring vegetation.



The image here shows the difference in red light reflectance prior to and immediately after the storms. The image is enhanced to identify tornado damage (scarred) areas as white streaks.



Further in time from the event, damaged vegetation will often die, improving the sharpness of scars for a limited time until vegetation is replaced.



These vegetation change products supported the National Weather Service damage assessment efforts by giving a “big picture” view for comparison to detailed field surveys. Here, icons mark the beginning and ending point of each surveyed tornado.

“MODIS imagery helped us in adjusting a tornado track which tracked from northeastern Alabama into extreme northwestern Georgia. It helped us get a better big-picture view and link up our survey with one performed by our colleagues the Peachtree City, Georgia office to confirm one consistent track.” – David Nadler, NWS Warning Coordination Meteorologist, Huntsville, Alabama

“We used the data to confirm that the Tuscaloosa tornado start point was in Greene County, as we suspected. This was initially confusing because we had leftover damage from the April 15th event that could have been easily attributed to April 27th. The April 15th paths did not show up on the data, at least not like the 27th.” – Kevin Laws, Science and Operations Officer, Birmingham, Alabama

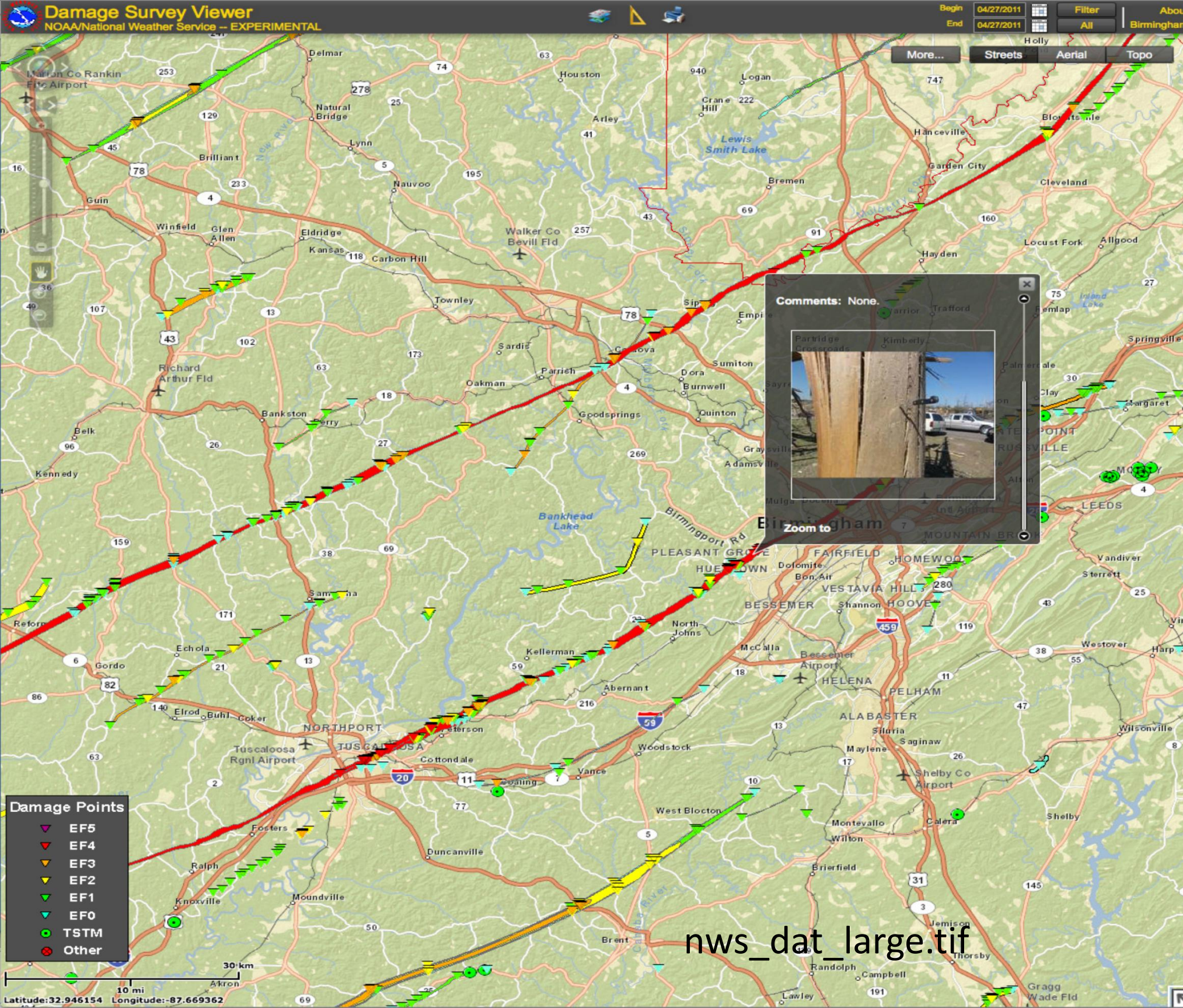
2732x2304

(Replace with ASTER RGB + Radar Animation)

Other satellite instruments can provide a more detailed view of the damage, when data are available.

At left, this animation shows the migration of supercell thunderstorms and tornadic signatures across a damage scar evident from the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER).

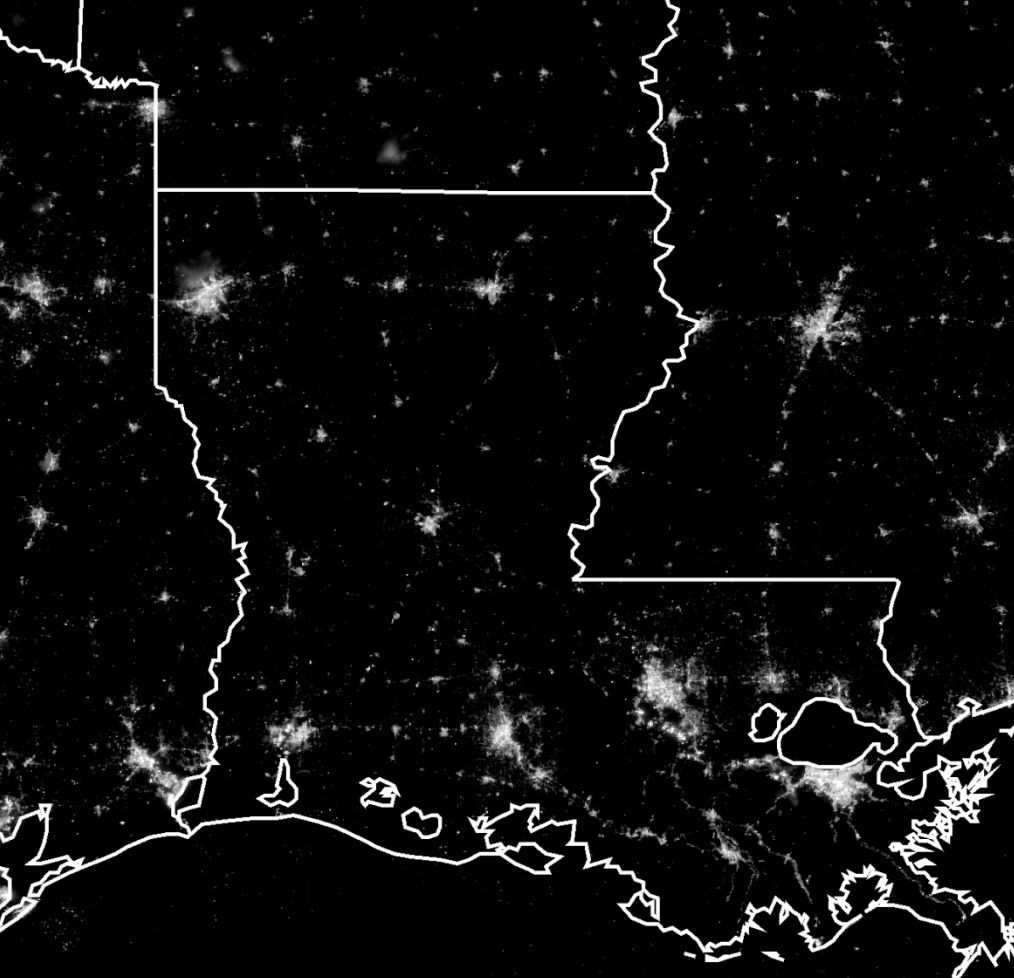
At 15 m spatial resolution, this false color composite of visible and near-infrared reflectance identifies a damage scar (cyan) that lies directly beneath the hook echo and debris ball associated with radar signatures observed from nearby Columbus Air Force Base, Mississippi.



NASA's Applied Sciences Disasters Program has awarded a proposal to help incorporate satellite data sets within National Weather Service (NWS) operations.

The NWS has developed a Damage Assessment Toolkit (left) that allows storm survey meteorologists to create georeferenced photos and other observations needed to assign tornado intensity.

Our proposed activity will incorporate MODIS, ASTER, and other satellite observations for use in the damage assessment process.

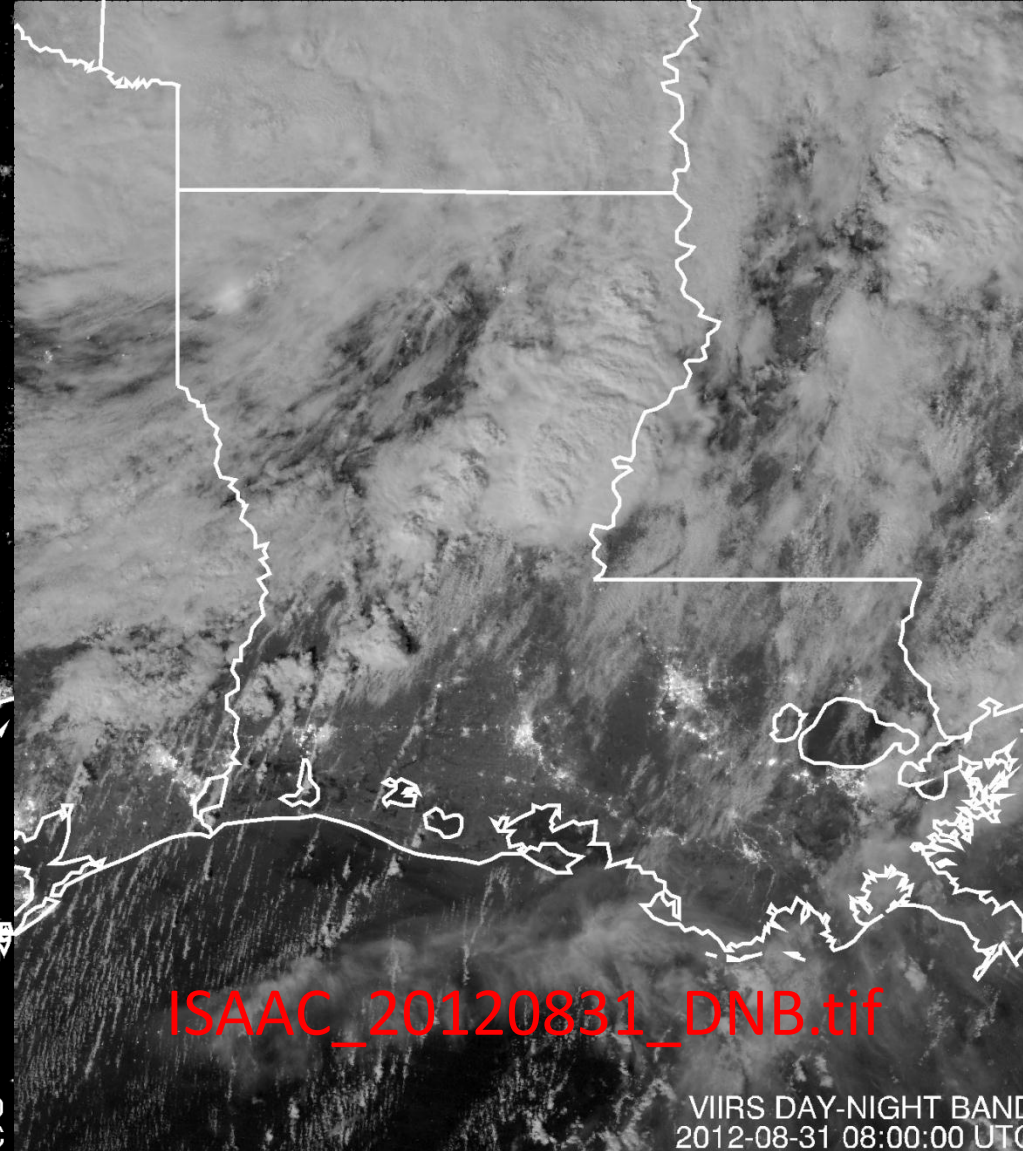


ISAAC_20120827_DNB.tif

VIIRS DAY-NIGHT BAND
2012-08-27 07:35:00 UTC

The day-night band provided by the Visible and Infrared Imaging Radiometer Suite (VIIRS) on the Suomi National Polar-Orbiting Partnership allows for the detection of city lights, fires, and moonlit clouds.

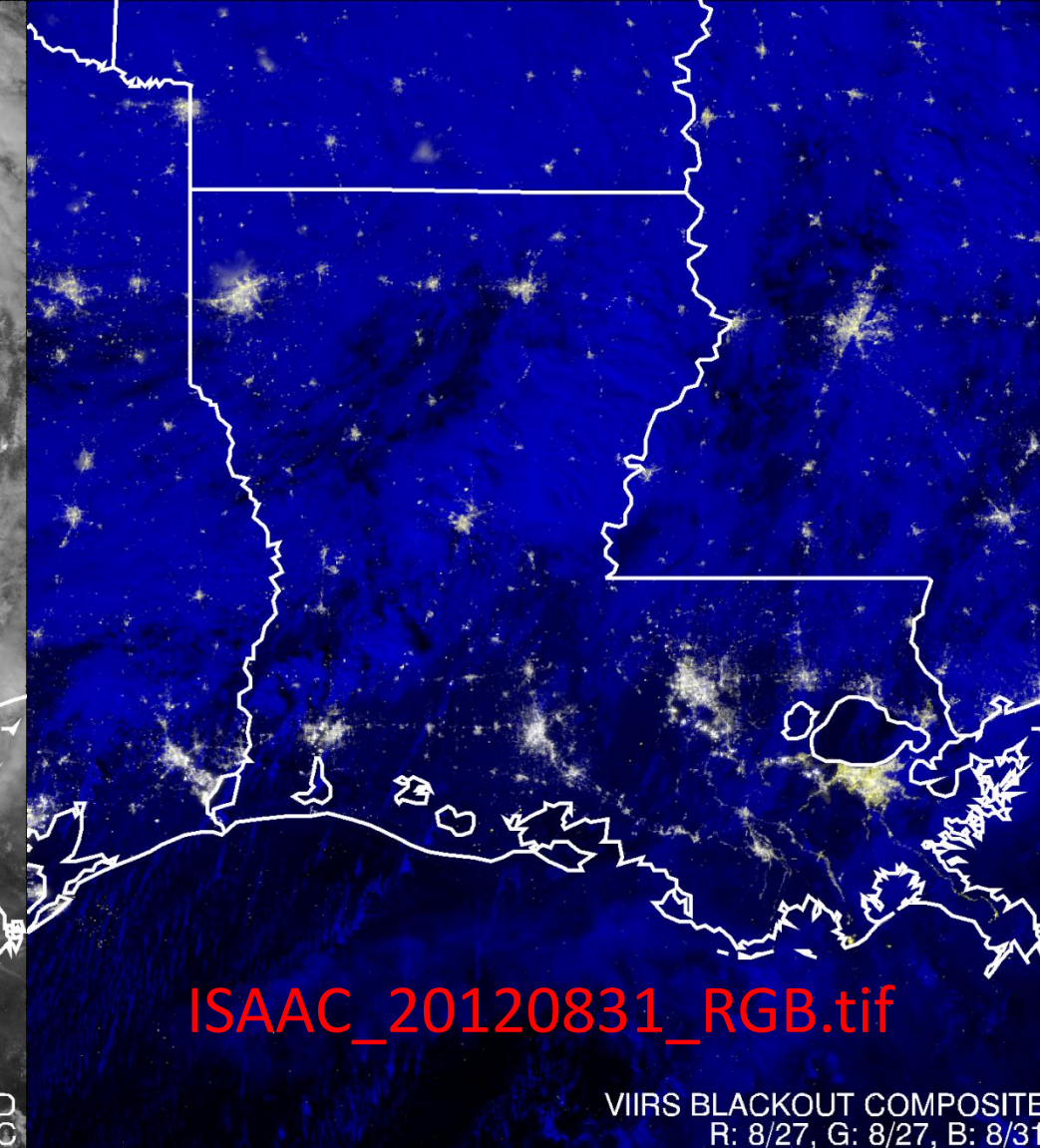
Here, many cities in Louisiana, Mississippi, and Texas are visible in nearly cloud-free conditions on August 27, 2012 prior to the landfall of Hurricane Isaac.



ISAAC_20120831_DNB.tif

VIIRS DAY-NIGHT BAND
2012-08-31 08:00:00 UTC

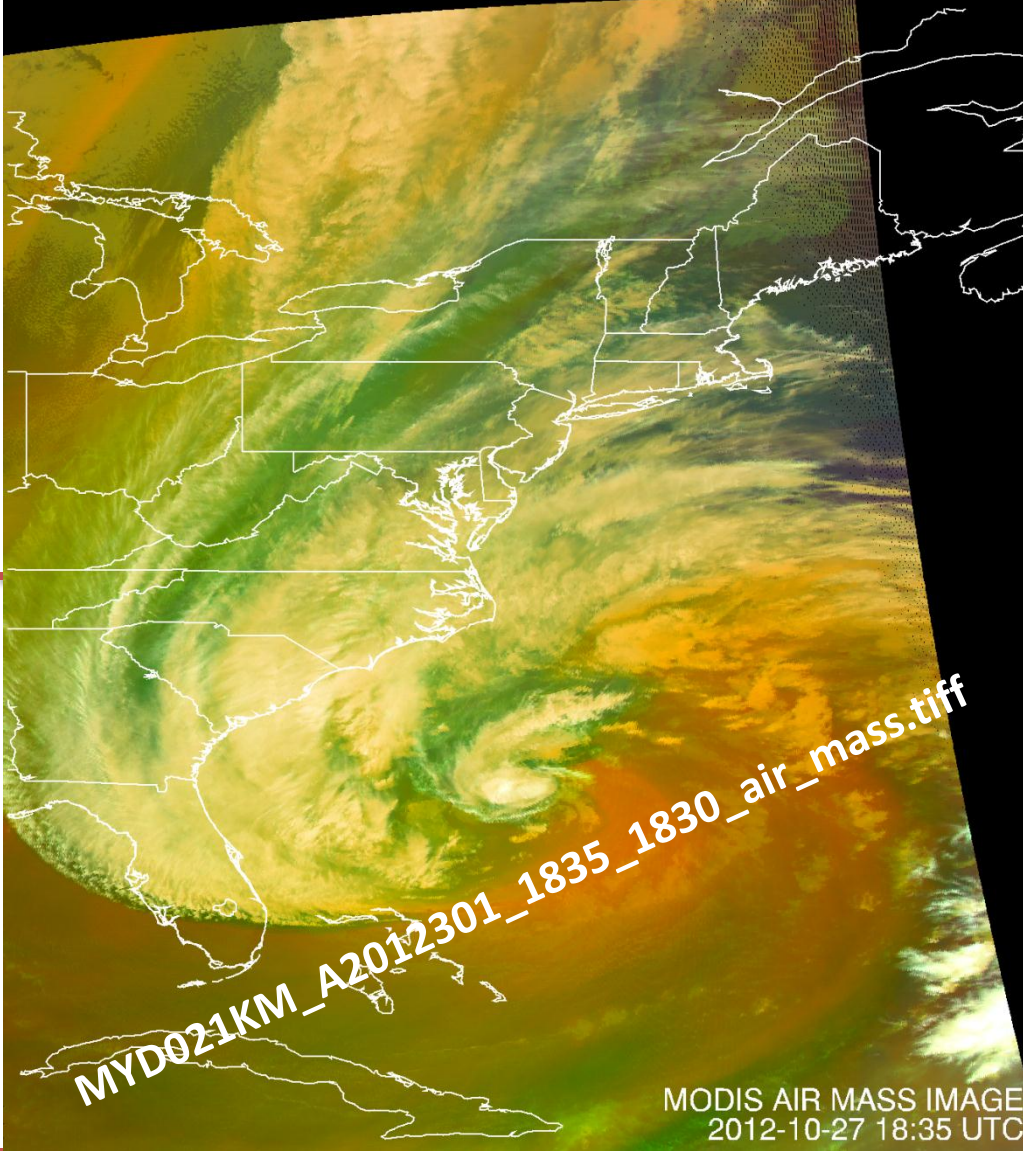
As it came ashore, strong winds associated with Isaac led to power outages throughout New Orleans. In this day-night band image, clouds are illuminated by reflected moonlight, with some cities still visible. Much of the brightness from New Orleans is reduced due to power outage.



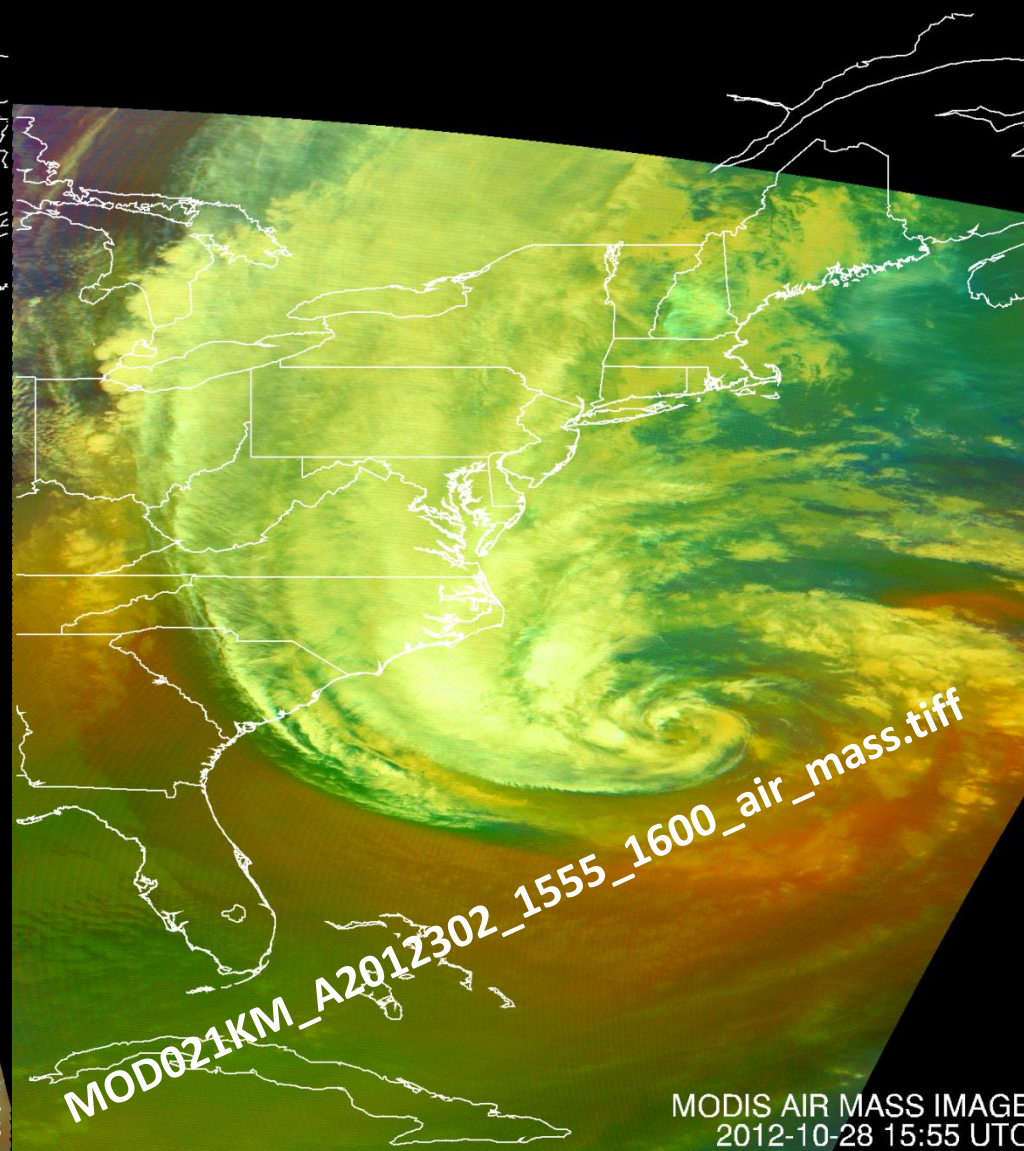
ISAAC_20120831_RGB.tif

VIIRS BLACKOUT COMPOSITE
R: 8/27, G: 8/27, B: 8/31

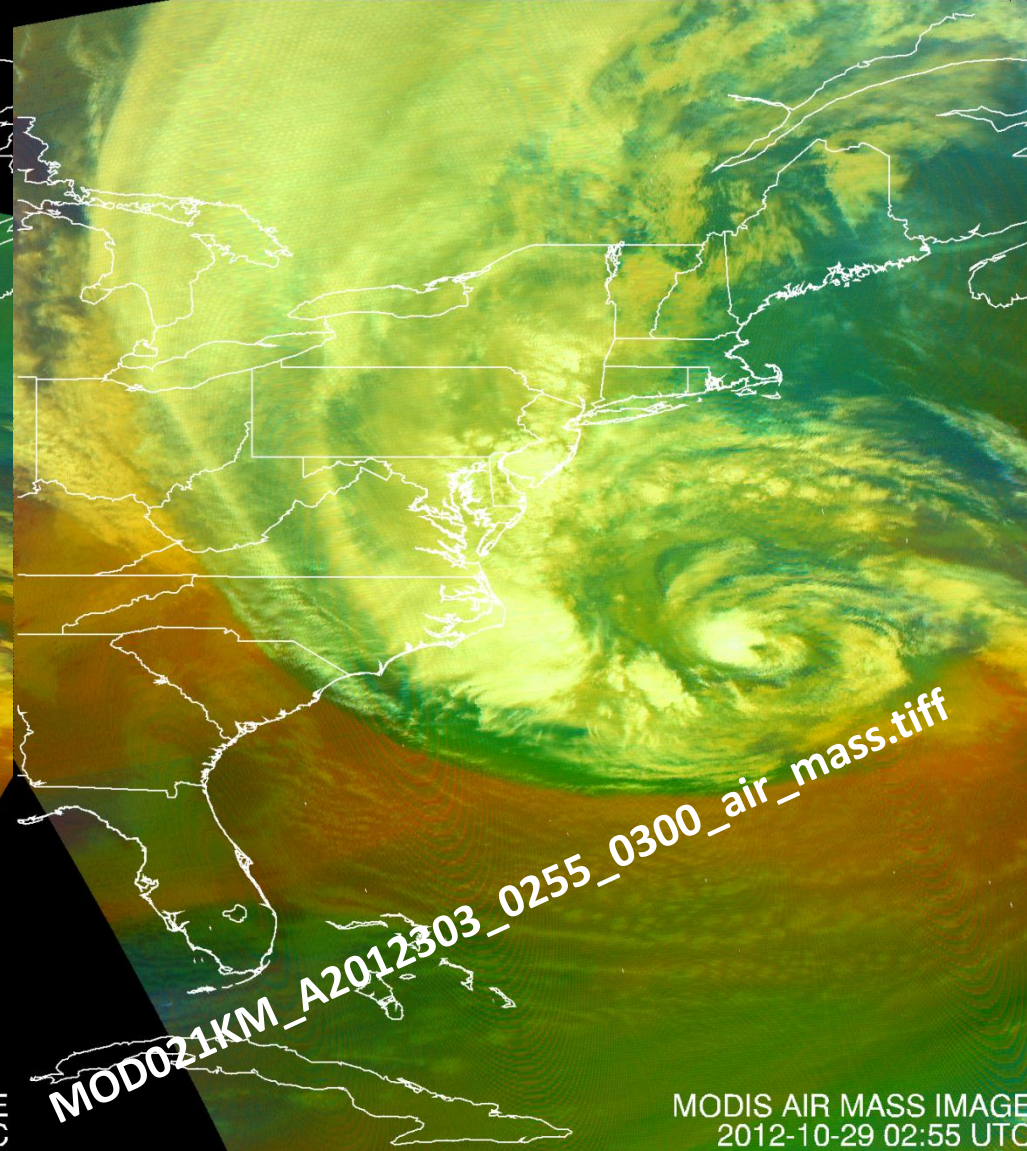
SPoRT is experimenting with false color composites useful for identifying blackouts. In this image, red and green intensity is represented by pre-storm lighting. The post-storm component provides the red intensity. The result is that for cloud-free conditions, power outages such as those in the New Orleans area result in yellow shades.



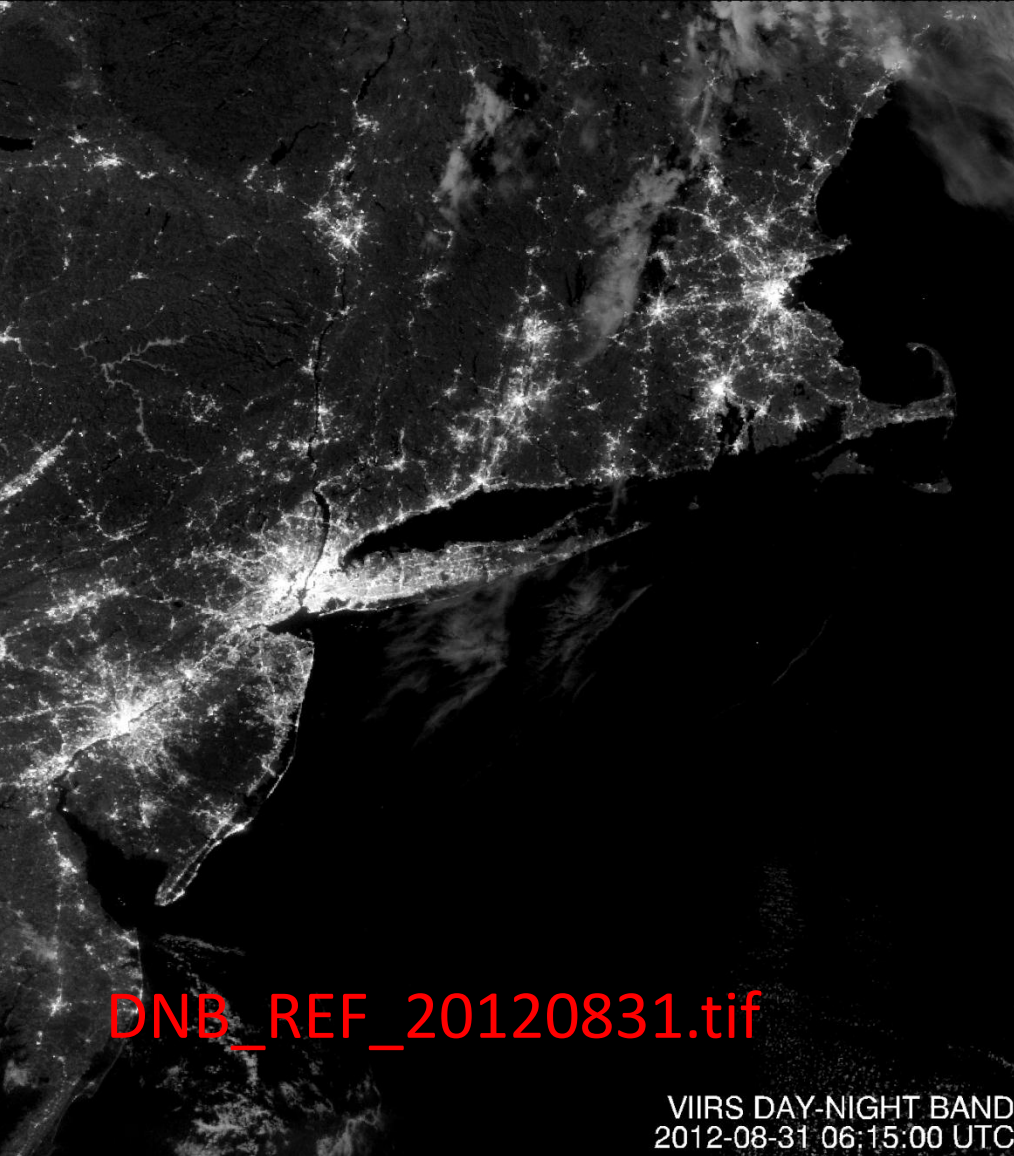
Future geostationary satellites, such as GOES-R, will have imaging capabilities with spectral bands and resolution similar to MODIS. To prepare forecasters for the GOES-R era, SPoRT is involved in NOAA's Satellite Proving Ground activities.



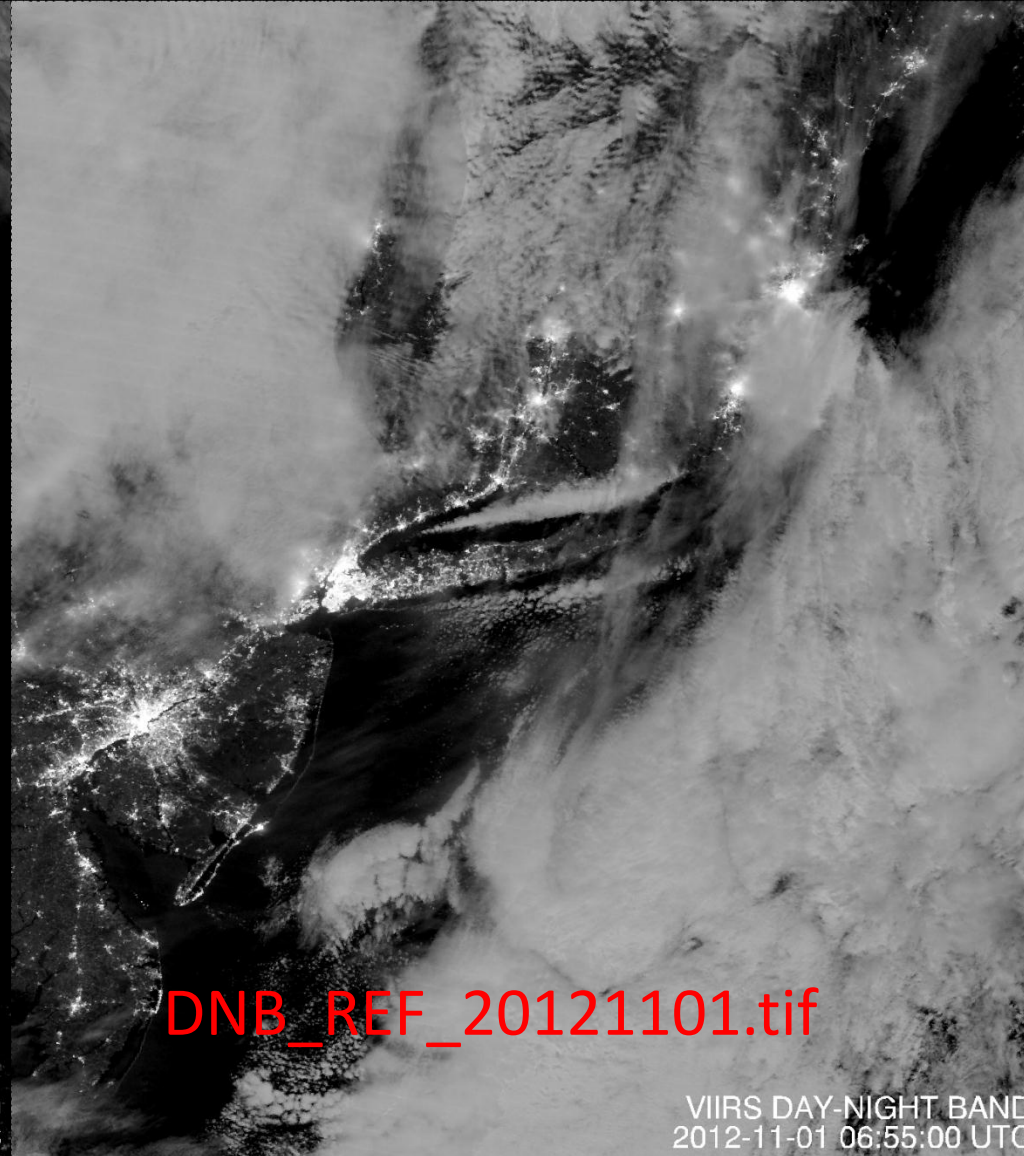
Products from MODIS are generated to simulate future GOES-R capabilities to expose forecasters to future capabilities. In these images, false color composites highlight air mass characteristics surrounding Hurricane Sandy.



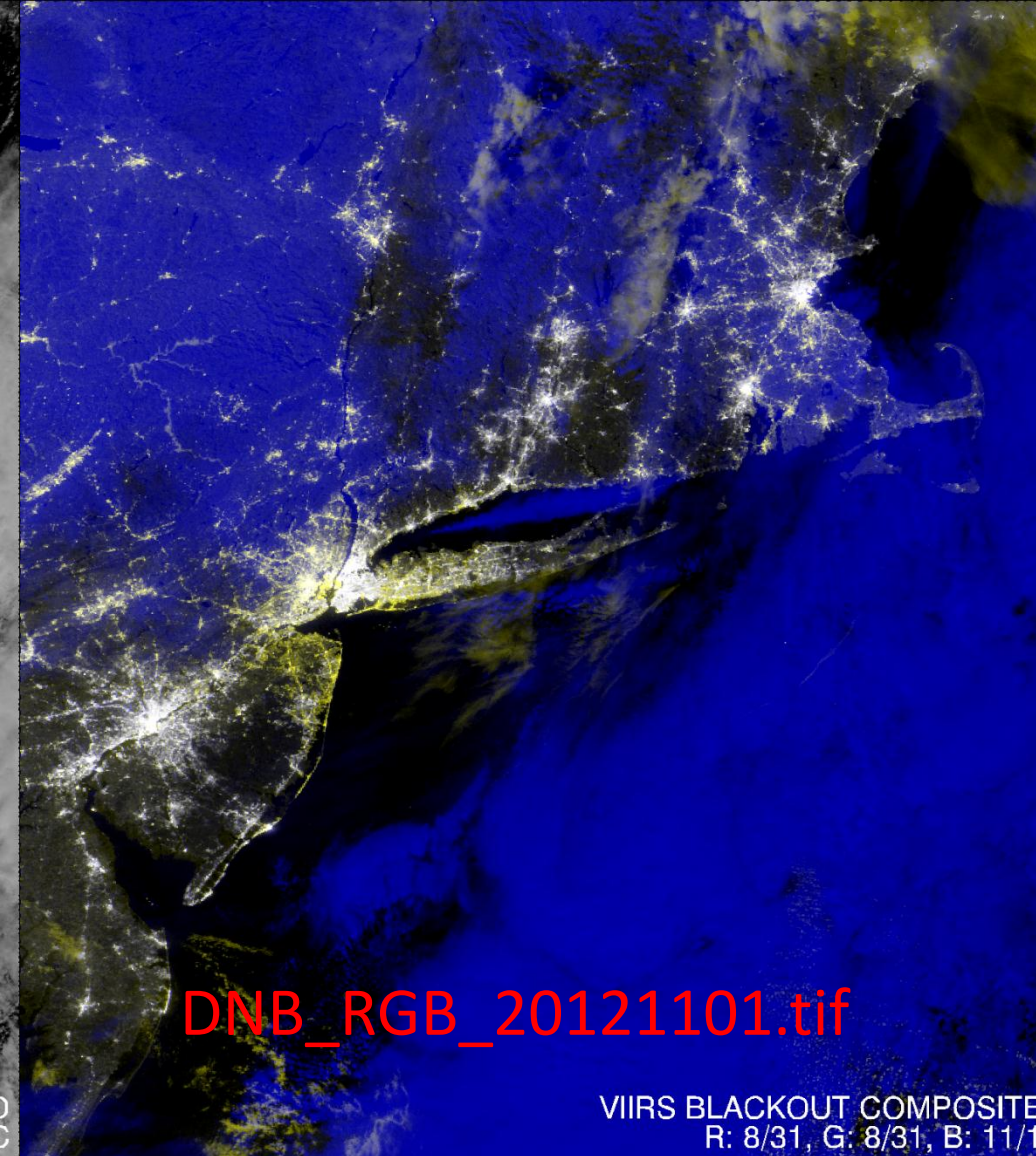
Combinations of ozone, water vapor, and cloud top temperature information identify warm, dry air masses (oranges) and deeper tropical moisture (greens) associated with the storm. Images like these are provided to NOAA's National Hurricane Center for experimental use and evaluation. Similar capabilities will be available from GOES-R in five minute increments.



As in the case of Isaac, the VIIRS day-night band can be used to help identify widespread power outages. For comparison, here are nearly cloud-free conditions on the morning of August 31, 2012.



After landfall, clear skies were present over much of New York City, Long Island, and New Jersey on November 1. Much of the light in New Jersey and Long Island is reduced versus August 31.



SPoRT's experimental false color composite highlights the power outages in yellow, coincident with widespread media reports. These images were provided to the USGS Hazards Data Distribution System and then to the U.S. Army, who used the imagery to make decisions regarding the staging of generators.